

HYDROTHERMAL ALTERATION OF MARTIAN ZIRCONS IN NWA 7034/7533.

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Introduction: The martian regolith breccia NWA 7034/7533 contains abundant zircon grains, which can provide insight into crustal processes through isotopic compositions. For example, *in-situ* U-Pb measurements on these zircons suggest a crystallization age of ~4.4 Ga with resetting at 1.5-1.7 Ga [1-3]. On the basis of intragrain and intergrain oxygen isotope variations, Nemchin et al. [4] proposed that zircons crystallized from melts that had assimilated ¹⁷O-enriched regolith, and that the metamict zircons were later altered by low-temperature fluids near the surface at ~1.7 Ga. Here, we describe the textural context of zircons in NWA 7034 and 7533, with an emphasis on those aspects touching on their hydrothermal alteration.

Results and Discussion: Zircon in NWA 7034/7533 is known to occur as isolated grains and in monzonite clasts [1-4]. We observed both of these types of occurrences in our sections but also some additional textural associations. Highly altered zircons were observed in a xenotime-bearing clast dominated by altered pyrite and ilmenite [5]. These zircons are anhedral in shape with crackled textures and appear dark in cathodoluminescence imaging. We also observed a hedenbergite grain with 20 zircons, all of which contain 'spongy' interiors (e.g., Fig. 1). In addition, some of the isolated zircon grains display oscillatory or sector zoning, a few of which contains regions/zones rich in submicron fluid-inclusions.

Zircon is generally resistant to surface weathering, so the fluid-inclusion-bearing zones and spongy interiors indicate interaction with or growth from hydrothermal fluids [6]. The fluid inclusions may contribute significantly to the enriched ¹⁷O data of [4] on ~4.4 Ga and 1.7 Ga zircons. Together with evidence of the alteration of rare-earth minerals in these samples [5], our observations provide additional support for hydrothermal environments in Martian crust at ~1.5-1.7 Ga.

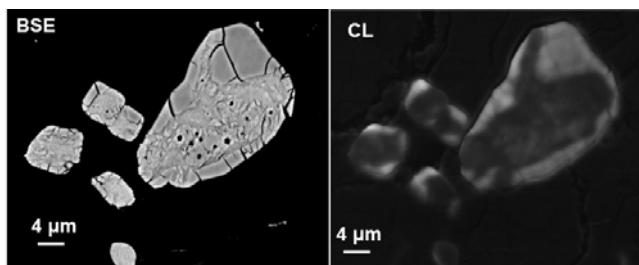


Fig. 1. Back scattered electron (BSE) and cathodoluminescence (CL) images of zircons in a hedenbergite.

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